

**Assessment of Air Quality in the Shuttle and International Space Station (ISS)
Based on Samples Returned by STS-104 at the Conclusion of 7A**

The toxicological assessment of air samples returned at the end of the STS-104 (7A) flight to the ISS is reported. ISS air samples were taken in June and July 2001 from the Service Module, FGB, and U.S. Laboratory using grab sample canisters (GSCs) and/or formaldehyde badges. Preflight and end-of-mission samples were obtained from *Atlantis* using GSCs. Solid sorbent air sampler (SSAS) samples were obtained from the ISS in April, June, and July. Analytical methods have not changed from earlier reports, and all quality control measures were met.

The two general criteria used to assess air quality are the total-non-methane-volatile organic hydrocarbons (NMVOCs) and the total T-value (minus the CO₂ and formaldehyde contribution). Because of the Freon 218 (octafluoropropane, OFP) leak, its contribution to the NMVOC is indicated in brackets. When comparing the NMVOC values with the 25 mg/m³ guideline, the OFP contributions should be subtracted. Control of atmospheric alcohols is important to the water recovery system engineers, hence total alcohols were also assessed in each sample. Formaldehyde (methanal) is quantified separately. These five indices are summarized below:

Sample Location	Date/Type	NMVOCs [OFP]		T Value ^a	Alcohols	Methanal
		(mg/m ³)	(mg/m ³)	(units)	(mg/m ³)	(mg/m ³)
Lab-SSAS	4/09/01	28	[22]	0.50	1.6	0.024
SM-SSAS	4/09/01	38	[34]	0.31	0.7	0.019
Lab-SSAS	6/13/01	36	[27]	0.66	4.3	0.038
Lab-GSC	6/13/01	42	[34]	0.56	2.8	0.038
FGB-GSC	6/13/01	47	[40]	0.81	3.1	ns ^b
SM-SSAS	6/13/01	86	[77]	0.76	2.6	0.031
SM-GSC	6/13/01	46	[38]	0.61	3.0	0.031
Lab-SSAS	7/9/01	46	[38]	0.54	3.9	0.038
Lab-GSC	7/9/01	43	[38]	0.33	2.3	0.038
FGB-GSC	7/9/01	62	[55]	0.52	2.4	ns
SM-GSC	7/9/01	71	[67]	0.59	1.9	0.026
Shuttle middeck-GSC	7/12/01(preflt)	0.2	[0]	0.02	0.1	ns
Shuttle middeck-GSC	7/23/01(EOM) ^b	48	[40]	0.47	3.8	ns
Acceptable Guideline>>>		<25	[85000]	<1	<10	0.050

^a Formaldehyde (methanal) and CO₂ not included in T calculation.

^b ns = not sampled and EOM = end of mission sample

Taken as a whole, these data suggest that air pollutants were controlled to acceptable levels to protect crew health. The increase in the average OFP concentration between the June and July GSC samples, and the higher quantity in the July SM GSC sample suggest that OFP was leaking from an ISS system in the SM faster than it was being scrubbed from the air. The concentration of OFP was far below any that would cause a health concern. To the extent that the samples were representative of each respective vehicle atmosphere, there was no evidence that *Atlantis* contributed significantly to the alcohol load in the ISS atmosphere.

Enclosures

1A: Analytical Results of 7A and STS-104 GSC Air Samples

1B: Analytical results of 7A SSAS tubes

2A: T Values of 7A and STS-104 Air Samples

2B: T Values of 7A SSAS tubes

TABLE 1A
ANALYTICAL RESULTS OF
ISS 7A AND STS-104 CONTAINER AIR SAMPLES

CHEMICAL CONTAMINANT	CONCENTRATION (mg/m3)							
	AA03150 S/N 1020 LAB 6/13/01@08:15GMT	AA03151 S/N 1045 FGB 6/13/01@08:16 GMT	AA03152 S/N 1008 SERVICE MODULE 6/13/01@08:17GMT	AA03153 S/N 1004 LAB 7/9/01@15:45GMT	AA03154 S/N 1039 FGB 7/9/01@15:47GMT	AA03155 S/N 1042 SERVICE MODULE 7/9/01@15:55GMT	AA03128 S/N 1008 PREFLIGHT 07/12/01	AA03156 S/N 1011 MIDDECK MET 11/14:05 7/23/01@23:10GMT
TARGET COMPOUNDS (TO-14/POLAR)***								
FREON 12	# TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	<0.05	TRACE
CHLOROMETHANE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	<0.05	TRACE
FREON 114	*<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
METHANOL	0.22	0.25	0.25	0.20	0.23	0.19	TRACE	0.48
ACETALDEHYDE	0.17	0.23	0.22	0.10	0.14	0.12	TRACE	0.16
VINYL CHLORIDE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
BROMOMETHANE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
ETHANOL	2.31	2.40	2.35	1.78	1.77	1.37	TRACE	1.86
CHLOROETHANE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
ACETONITRILE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE
PROPENAL	<0.020	TRACE	<0.020	<0.020	<0.020	TRACE	<0.020	<0.020
ACETONE	0.13	0.18	0.15	0.13	0.14	0.12	TRACE	0.21
PROPANAL	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE
2-PROPANOL	0.08	0.09	0.09	0.08	0.08	0.07	TRACE	1.21
FREON 11	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
FURAN	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
ACRYLONITRILE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	<0.05	<0.05
PENTANE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2-METHYL-2-PROPANOL	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	TRACE
METHYL ACETATE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,1-DICHLOROETHENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
DICHLOROMETHANE	0.20	0.23	0.21	0.12	0.12	0.10	<0.05	0.36
3-CHLOROPROPENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
FREON 113	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
N-PROPANOL	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	<0.05	<0.05
1,1-DICHLOROETHANE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
BUTANAL	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	<0.05	TRACE
2-BUTANONE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	<0.05	TRACE
1,2-DICHLOROETHENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2-METHYLFURAN	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
ETHYL ACETATE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	<0.05	<0.05
HEXANE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
CHLOROFORM	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2-BUTENAL	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,2-DICHLOROETHANE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	<0.05	<0.05
1,1,1-TRICHLOROETHANE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
N-BUTANOL	0.11	0.12	0.12	0.12	0.13	0.11	TRACE	TRACE
BENZENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
CARBON TETRACHLORIDE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2-PENTANONE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
PENTANAL	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	<0.05	TRACE
1,2-DICHLOROPROPANE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,4-DIOXANE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
TRICHLOROETHENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2,5-DIMETHYLFURAN	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4-METHYL-2-PENTANONE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
CIS-1,3-DICHLOROPROPENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2-PENTENAL	<0.05	TRACE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
TRANS-1,3-DICHLOROPROPENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,1,2-TRICHLOROETHANE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
TOLUENE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	<0.05	TRACE
HEXANAL	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE
MESITYL OXIDE	<0.05	TRACE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,2-DIBROMOETHANE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
BUTYL ACETATE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	<0.05	<0.05
TETRACHLOROETHENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

TABLE 1A
ANALYTICAL RESULTS OF
ISS 7A AND STS-104 CARRIER AIR SAMPLES

CHEMICAL CONTAMINANT	CONCENTRATION (mg/m ³)							
	AA03150 S/N 1020 LAB 6/13/01@08:15GMT	AA03151 S/N 1045 FGB 6/13/01@08:16 GMT	AA03152 S/N 1008 SERVICE MODULE 6/13/01@08:17GMT	AA03153 S/N 1004 LAB 7/9/01@15:45GMT	AA03154 S/N 1039 FGB 7/9/01@15:47GMT	AA03155 S/N 1042 SERVICE MODULE 7/9/01@15:55GMT	AA03128 S/N 1008 PREFLIGHT 07/12/01	AA03156 S/N 1011 MIDDECK MET 11/14:05 7/23/01@23:10GMT
CHLOROBENZENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
ETHYL BENZENE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	<0.05	<0.05
M- + P-XYLENES	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	<0.05	<0.05
2-HEPTANONE	<0.05	TRACE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
CYCLOHEXANONE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	<0.05	<0.05
HEPTANAL	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	<0.05	TRACE
STYRENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,1,2,2-TETRACHLOROETHANE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
O-XYLENE	0.09	0.11	0.10	0.06	0.07	0.06	<0.05	<0.05
1,3,5-TRIMETHYLBENZENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,2,4-TRIMETHYLBENZENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,3-DICHLOROBENZENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,4-DICHLOROBENZENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,2-DICHLOROBENZENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,2,4-TRICHLOROBENZENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
HEXACHLORO-1,3-BUTADIENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
TARGET COMPOUNDS (TOXIC)								
1,3-BUTADIENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
ETHYLENE OXIDE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
CARBON DISULFIDE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	<0.05	TRACE
2-METHYL-2-PROPENAL	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3-BUTEN-2-ONE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
DIMETHYLDISULFIDE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2-ETHOXYETHANOL	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
OCTAMETHYLCYCLOTETRAILOXANE	1.54	0.70	1.50	0.37	1.39	0.31	TRACE	1.17
NON-TARGET COMPOUNDS								
OCTAFLUOROPROPANE***	34.0	40.2	37.9	38.4	55.0	67.1	BL	39.7
CHLOROPENTAFLUOROETHANE	0.01	0.01	0.01	0.01	0.01	0.01	BL	0.01
BROMOTRIFLUOROMETHANE	&BL	BL	BL	BL	BL	BL	BL	0.46
2-METHYLPROPANE	BL	BL	BL	BL	BL	BL	BL	0.03
HEXAMETHYLCYCLOTRISILOXANE	2.14	1.29	2.51	0.85	2.00	0.65	BL	1.00
LIMONENE	0.05	0.06	0.07	0.08	0.10	0.11	BL	0.004
DECAMETHYLCYCLOPENTASILOXANE	0.39	0.31	0.34	0.28	0.47	0.27	BL	1.09
TOTAL ALCOHOLS PLUS ACETONE	2.85	3.06	2.99	2.34	2.39	1.87	0.13	3.78
TARGET COMPOUNDS (GC)***								
ETHYLENE	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
CARBON MONOXIDE	<1.1	TRACE	<1.1	TRACE	<1.1	<1.1	<1.1	3.4
METHANE	1.8	2.0	1.9	1.7	1.0	1.0	1.6	30.0
HYDROGEN	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	<1.6	TRACE
CARBON DIOXIDE	13000	13000	13000	6300	5800	5500	830	3100
TOTAL CONCENTRATION (NON-METHANE HYDROCARBONS)	41.9	46.7	46.3	43.0	62.1	71.1	0.25	48.1

* <: Value is less than the laboratory report detection limit, and summed as 0.0.

TRACE: Amount detected is sufficient for compound identification only. Calculations are based on one-half of the laboratory report detection limit (1.1 mg/m³ for CO; 0.65 mg/m³ for CH₄; 0.41 mg/m³ for H₂; 0.05 mg/m³ for VOCs; and 0.02 mg/m³ for propenal.)

& BL: Area below the search routine limit (<20% of the fluorobenzene peak area).

***Measurements are calibrated by multi-point initial calibration and verified by mid-point continuing calibration.

TABLE 1B
ANALYTICAL RESULTS OF
ISS SOLID SORBENT AIR SAMPLES at the CONCLUSION of 7A and RETURNED on STS-104

CHEMICAL CONTAMINANT	CONCENTRATION (mg/m3)				
	AA03134 LAB SN0011 TUBE 2 4/09/01@17:45GMT 4/10/01@18:20GMT	AA03135 LAB SN0011 TUBE 3 6/13/01@08:15GMT 6/14/01@08:20GMT	AA03136 LAB SN0011 TUBE 4 7/09/01@15:45GMT 7/10/01@16:35GMT	AA03143 SERVICE MODULE SN0013 TUBE 2 4/09/01@17:50GMT 4/11/01@07:15GMT	AA03144 SERVICE MODULE SN0013 TUBE 3 6/13/01@08:20GMT 6/14/01@09:00GMT
TARGET COMPOUNDS (TO-14/POLAR)***					
FREON 12	0.03	0.02	0.02	0.02	TRACE
CHLOROMETHANE	# TRACE	TRACE	TRACE	TRACE	TRACE
FREON 114	* < 0.16	< 0.014	< 0.015	< 0.014	< 0.032
METHANOL	0.23	0.27	0.28	0.08	0.14
ACETALDEHYDE	0.12	0.38	0.26	0.07	0.21
VINYL CHLORIDE	< 0.016	TRACE	TRACE	< 0.014	< 0.032
BROMOMETHANE	< 0.016	< 0.014	< 0.015	< 0.014	< 0.032
ETHANOL	0.87	3.55	3.07	0.41	1.96
CHLOROETHANE	TRACE	TRACE	TRACE	TRACE	< 0.032
ACETONITRILE	TRACE	TRACE	TRACE	TRACE	TRACE
PROPENAL	< 0.006	TRACE	TRACE	< 0.006	< 0.013
ACETONE	0.16	0.14	0.17	0.10	0.14
PROPANAL	TRACE	TRACE	TRACE	TRACE	TRACE
2-PROPANOL	0.12	0.18	0.15	0.06	0.19
FREON 11	< 0.016	TRACE	TRACE	< 0.014	< 0.032
FURAN	< 0.016	< 0.014	< 0.015	< 0.014	< 0.032
ACRYLONITRILE	TRACE	TRACE	TRACE	TRACE	TRACE
PENTANE	TRACE	TRACE	TRACE	TRACE	< 0.032
2-METHYL-2-PROPANOL	TRACE	TRACE	TRACE	TRACE	TRACE
METHYL ACETATE	TRACE	TRACE	TRACE	TRACE	< 0.032
1,1-DICHLOROETHENE	< 0.016	< 0.014	< 0.015	< 0.014	< 0.032
DICHLOROMETHANE	0.30	0.25	0.20	0.16	0.20
3-CHLOROPROPENE	< 0.016	< 0.014	< 0.015	< 0.014	< 0.032
FREON 113	0.02	TRACE	TRACE	TRACE	< 0.032
N-PROPANOL	0.03	0.03	0.04	TRACE	TRACE
1,1-DICHLOROETHANE	< 0.016	< 0.014	< 0.015	< 0.014	< 0.032
BUTANAL	TRACE	TRACE	TRACE	TRACE	TRACE
2-BUTANONE	0.03	0.03	0.04	0.02	TRACE
CIS-1,2-DICHLOROETHENE	< 0.016	< 0.014	< 0.015	< 0.014	< 0.032
2-METHYLFURAN	< 0.016	< 0.014	< 0.015	< 0.014	< 0.032
ETHYL ACETATE	0.04	0.04	0.03	0.03	0.03
HEXANE	< 0.016	< 0.014	< 0.015	< 0.014	< 0.032
CHLOROFORM	< 0.016	< 0.014	< 0.015	< 0.014	< 0.032
2-BUTENAL	< 0.016	TRACE	TRACE	< 0.014	< 0.032
1,2-DICHLOROETHANE	TRACE	TRACE	TRACE	TRACE	TRACE
1,1,1-TRICHLOROETHANE	< 0.016	< 0.014	< 0.015	< 0.014	< 0.032
N-BUTANOL	0.18	0.14	0.20	0.10	0.12
BENZENE	TRACE	TRACE	TRACE	TRACE	TRACE
TETRACHLOROMETHANE	< 0.016	< 0.014	< 0.015	< 0.014	< 0.032
2-PENTANONE	< 0.016	< 0.014	< 0.015	< 0.014	< 0.032
PENTANAL	< 0.016	< 0.014	< 0.015	TRACE	TRACE
1,2-DICHLOROPROPANE	TRACE	TRACE	TRACE	TRACE	< 0.032
1,4-DIOXANE	< 0.016	TRACE	TRACE	< 0.014	< 0.032
TRICHLOROETHENE	< 0.016	< 0.014	< 0.015	< 0.014	< 0.032
2,5-DIMETHYLFURAN	< 0.016	< 0.014	< 0.015	< 0.014	< 0.032
4-METHYL-2-PENTANONE	TRACE	TRACE	TRACE	TRACE	TRACE
CIS-1,3-DICHLOROPROPENE	< 0.016	< 0.014	< 0.015	< 0.014	< 0.032
2-PENTENAL	< 0.016	< 0.014	< 0.015	< 0.014	< 0.032
TRANS-1,3-DICHLOROPROPENE	< 0.016	< 0.014	< 0.015	< 0.014	< 0.032
1,1,2-TRICHLOROETHANE	< 0.016	< 0.014	< 0.015	< 0.014	< 0.032
TOLUENE	0.06	0.04	0.07	0.05	0.04
HEXANAL	TRACE	TRACE	TRACE	TRACE	TRACE
MESITYL OXIDE	TRACE	TRACE	TRACE	< 0.014	< 0.032
1,2-DIBROMOETHANE	< 0.016	< 0.014	< 0.015	< 0.014	< 0.032
BUTYL ACETATE	TRACE	TRACE	TRACE	TRACE	TRACE
TETRACHLOROETHENE	TRACE	TRACE	TRACE	< 0.014	< 0.032
CHLOROBENZENE	TRACE	TRACE	TRACE	TRACE	TRACE
ETHYLBENZENE	TRACE	TRACE	TRACE	TRACE	TRACE
META+PARA-XYLENES	0.06	0.05	0.05	0.04	0.04
2-HEPTANONE	TRACE	TRACE	TRACE	TRACE	< 0.032
CYCLOHEXANONE	0.05	0.03	0.04	0.02	TRACE
HEPTANAL	TRACE	TRACE	TRACE	TRACE	TRACE
STYRENE	TRACE	TRACE	TRACE	< 0.014	< 0.032
1,1,2,2-TETRACHLOROETHANE	< 0.016	< 0.014	< 0.015	< 0.014	< 0.032

TABLE 1B
ANALYTICAL RESULTS OF
ISS SOLID SORBENT AIR SAMPLES at the CONCLUSION of 7A and RETURNED on STS-104

CHEMICAL CONTAMINANT	CONCENTRATION (mg/m3)				
	AA03134 LAB SN0011 TUBE 2 4/09/01@17:45GMT 4/10/01@18:20GMT	AA03135 LAB SN0011 TUBE 3 6/13/01@08:15GMT 6/14/01@08:20GMT	AA03136 LAB SN0011 TUBE 4 7/09/01@15:45GMT 7/10/01@16:35GMT	AA03143 SERVICE MODULE SN0013 TUBE 2 4/09/01@17:50GMT 4/11/01@07:15GMT	AA03144 SERVICE MODULE SN0013 TUBE 3 6/13/01@08:20GMT 6/14/01@09:00GMT
ORTHO-XYLENE	0.11	0.12	0.10	0.07	0.11
1,3,5-TRIMETHYLBENZENE	< 0.016	< 0.014	< 0.015	< 0.014	< 0.032
1,2,4-TRIMETHYLBENZENE	TRACE	TRACE	TRACE	TRACE	< 0.032
1,3-DICHLOROBENZENE	< 0.016	< 0.014	< 0.015	< 0.014	< 0.032
1,4-DICHLOROBENZENE	TRACE	TRACE	TRACE	TRACE	TRACE
1,2-DICHLOROBENZENE	TRACE	< 0.014	< 0.015	< 0.014	< 0.032
1,2,4-TRICHLOROBENZENE	< 0.016	< 0.014	< 0.015	< 0.014	< 0.032
HEXACHLORO-1,3-BUTADIENE	< 0.023	< 0.02	< 0.022	< 0.021	< 0.048
TARGET COMPOUNDS (TOXIC)					
1,3-BUTADIENE	< 0.016	< 0.014	< 0.015	< 0.014	< 0.032
ETHYLENE OXIDE	< 0.016	< 0.014	< 0.015	< 0.014	< 0.032
CARBON DISULFIDE	TRACE	TRACE	TRACE	TRACE	TRACE
2-METHYL-2-PROPENAL	TRACE	TRACE	TRACE	TRACE	TRACE
3-BUTEN-2-ONE	TRACE	TRACE	TRACE	TRACE	TRACE
DIMETHYLDISULFIDE	< 0.016	TRACE	TRACE	< 0.014	< 0.032
2-ETHOXYETHANOL	< 0.016	TRACE	TRACE	< 0.014	< 0.032
OCTAMETHYLCYCLOTRASILOXANE	2.56	0.73	0.48	0.40	1.24
NON-TARGET COMPOUNDS					
OCTAFLUOROPROPANE***	21.5	27.0	38.4	33.7	77.1
CHLOROPENTAFLUOROETHANE	0.01	0.01	0.01	0.00	0.01
PROPENE	0.01	0.01	0.01	0.01	0.01
CARBONYL SULFIDE	0.02	0.01	0.01	0.01	0.03
TRIMETHYLSILANOL	0.10	0.10	0.14	0.04	0.06
2-METHYL-PROPANENITRILE	0.00	0.00	0.01	0.00	0.00
1,3-DIOXOLANE	0.02	0.02	0.03	0.01	0.01
1,2-DIMETHOXYETHANE	0.02	0.02	0.03	0.01	0.01
HEXAMETHYLCYCLOTRISILOXANE	0.71	1.72	0.70	1.20	3.23
BENZALDEHYDE	0.02	0.01	0.01	0.02	0.03
PINENE ISOMER	0.01	0.01	0.01	0.01	0.01
2-ETHYL-1-HEXANOL	0.02	0.02	0.04	0.03	0.01
LIMONENE	0.11	0.07	0.13	0.08	0.07
DECAMETHYLCYCLOPENTASILOXSANE	0.27	0.34	0.46	0.28	0.33
TOTAL ALCOHOLS PLUS ACETONE	1.58	4.30	3.91	0.74	2.55
TOTAL CONCENTRATION (NON-METHANE HYDROCARBONS)	28.5	36.2	46.1	37.7	85.9

* < : Values are less than the laboratory report detection limit.

TRACE: Amount detected is sufficient for compound identification only. Calculations are based on one-half of the laboratory report detection limit
(0.05 mg/m3 for VOCs; and 0.02 mg/m3 for propenal.)

***Measurements are calibrated by multi-point initial calibration and verified by mid-point continuing calibration

TABLE 2A
ANALYTICAL RESULTS OF
ISS 7A AND STS-104 CONTAINER AIR SAMPLES

CHEMICAL CONTAMINANT	T-VALUE (180-d SMAC)						T-VALUE (7-d SMAC)	
	AA03150 S/N 1020 LAB 6/13/01@08:15GMT	AA03151 S/N 1045 FGB 6/13/01@08:16 GMT	AA03152 S/N 1008 SERVICE MODULE 6/13/01@08:17GMT	AA03153 S/N 1004 LAB 7/9/01@15:45GMT	AA03154 S/N 1039 FGB 7/9/01@15:47GMT	AA03155 S/N 1042 SERVICE MODULE 7/9/01@15:55GMT	AA03128 S/N 1008 PREFLIGHT 07/12/01	AA03156 S/N 1011 MIDDECK MET 11/14:05 7/23/01@23:10GMT
TARGET COMPOUNDS (TO-14/POLAR)***								
FREON 12	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	ND	0.00005
CHLOROMETHANE	0.00061	0.00061	0.00061	0.00061	0.00061	0.00061	ND	0.00061
FREON 114	* ND	ND	ND	ND	ND	ND	ND	ND
METHANOL	0.02460	0.02824	0.02780	0.02242	0.02504	0.02082	0.00278	0.05284
ACETALDEHYDE	0.04287	0.05640	0.05504	0.02569	0.03413	0.03000	0.00625	0.03967
VINYL CHLORIDE	ND	ND	ND	ND	ND	ND	ND	ND
BROMOMETHANE	ND	ND	ND	ND	ND	ND	ND	ND
ETHANOL	0.00115	0.00120	0.00117	0.00089	0.00089	0.00068	0.00001	0.00093
CHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND
ACETONITRILE	0.00373	0.00373	0.00373	0.00373	0.00373	0.00373	0.00373	0.00373
PROPENAL	ND	0.33333	ND	ND	ND	0.33333	ND	ND
ACETONE	0.00251	0.00338	0.00298	0.00244	0.00277	0.00233	0.00048	0.00409
PROPANAL	0.00694	0.00694	0.00694	0.00694	0.00694	0.00694	0.00175	0.00175
2-PROPANOL	0.00056	0.00059	0.00060	0.00054	0.00056	0.00044	0.00017	0.00805
FREON 11	ND	ND	ND	ND	ND	ND	ND	ND
FURAN	ND	ND	ND	ND	ND	ND	ND	ND
ACRYLONITRILE	0.00893	0.00893	0.00893	0.00893	0.00893	0.00893	ND	ND
PENTANE	ND	ND	ND	ND	ND	ND	ND	ND
2-METHYL-2-PROPANOL	ND	ND	ND	ND	ND	ND	ND	0.00017
METHYL ACETATE	ND	ND	ND	ND	ND	ND	ND	ND
1,1-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND
DICHLOROMETHANE	0.01951	0.02343	0.02149	0.01189	0.01166	0.00989	ND	0.00721
3-CHLOROPROPENE	ND	ND	ND	ND	ND	ND	ND	ND
FREON 113	ND	ND	ND	ND	ND	ND	ND	ND
N-PROPANOL	0.00026	0.00026	0.00026	0.00026	0.00026	0.00026	ND	ND
1,1-DICHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND
BUTANAL	0.00568	0.00568	0.00568	0.00568	0.00568	0.00568	ND	0.00141
2-BUTANONE	0.00083	0.00083	0.00083	0.00083	0.00083	0.00083	ND	0.00083
1,2-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND
2-METHYLFURAN	ND	ND	ND	ND	ND	ND	ND	ND
ETHYL ACETATE	0.00014	0.00014	0.00014	0.00014	0.00014	0.00014	ND	ND
HEXANE	ND	ND	ND	ND	ND	ND	ND	ND
CHLOROFORM	ND	ND	ND	ND	ND	ND	ND	ND
2-BUTENAL	ND	ND	ND	ND	ND	ND	ND	ND
1,2-DICHLOROETHANE	0.02500	0.02500	0.02500	0.02500	0.02500	0.02500	ND	ND
1,1,1-TRICHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND
N-BUTANOL	0.00271	0.00296	0.00288	0.00309	0.00336	0.00265	0.00031	0.00031
BENZENE	ND	ND	ND	ND	ND	ND	ND	ND
CARBON TETRACHLORIDE	ND	ND	ND	ND	ND	ND	ND	ND
2-PENTANONE	ND	ND	ND	ND	ND	ND	ND	ND
PENTANAL	0.00472	0.00472	0.00472	0.00472	0.00472	0.00472	ND	0.00118
1,2-DICHLOROPROPANE	ND	ND	ND	ND	ND	ND	ND	ND
1,4-DIOXANE	ND	ND	ND	ND	ND	ND	ND	ND
TRICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND
2,5-DIMETHYLFURAN	ND	ND	ND	ND	ND	ND	ND	ND
4-METHYL-2-PENTANONE	ND	ND	ND	ND	ND	ND	ND	ND
CIS-1,3-DICHLOROPROPENE	ND	ND	ND	ND	ND	ND	ND	ND
2-PENTENAL	ND	0.01190	ND	ND	ND	ND	ND	ND
TRANS-1,3-DICHLOROPROPENE	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-TRICHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND
TOLUENE	0.00042	0.00042	0.00042	0.00042	0.00042	0.00042	ND	0.00042
HEXANAL	0.00410	0.00410	0.00410	0.00410	0.00410	0.00410	0.00101	0.00101
MESITYL OXIDE	ND	0.00063	ND	ND	ND	ND	ND	ND
1,2-DIBROMOETHANE	ND	ND	ND	ND	ND	ND	ND	ND
BUTYL ACETATE	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	ND	ND
TETRACHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND

TABLE 2A
ANALYTICAL RESULTS OF
ISS 7A AND STS-104 CONTAINER AIR SAMPLES

CHEMICAL CONTAMINANT	T-VALUE (180-d SMAC)						T-VALUE (7-d SMAC)	
	AA03150 S/N 1020 LAB 6/13/01@08:15GMT	AA03151 S/N 1045 FGB 6/13/01@08:16 GMT	AA03152 S/N 1008 SERVICE MODULE 6/13/01@08:17GMT	AA03153 S/N 1004 LAB 7/9/01@15:45GMT	AA03154 S/N 1039 FGB 7/9/01@15:47GMT	AA03155 S/N 1042 SERVICE MODULE 7/9/01@15:55GMT	AA03128 S/N 1008 PREFLIGHT 07/12/01	AA03156 S/N 1011 MIDDECK MET 11/14:05 7/23/01@23:10GMT
CHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND
ETHYL BENZENE	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	ND	ND
M- + P-XYLENES	0.00011	0.00011	0.00011	0.00011	0.00011	0.00011	ND	ND
2-HEPTANONE	ND	0.00109	ND	ND	ND	ND	ND	ND
CYCLOHEXANONE	0.00042	0.00042	0.00042	0.00042	0.00042	0.00042	ND	ND
HEPTANAL	0.00357	0.00357	0.00357	0.00357	0.00357	0.00357	ND	0.00089
STYRENE	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-TETRACHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND
O-XYLENE	0.00040	0.00049	0.00046	0.00026	0.00030	0.00028	ND	ND
1,3,5-TRIMETHYLBENZENE	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-TRIMETHYLBENZENE	ND	ND	ND	ND	ND	ND	ND	ND
1,3-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND
1,4-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND
1,2-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-TRICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND
HEXACHLORO-1,3-BUTADIENE	ND	ND	ND	ND	ND	ND	ND	ND
TARGET COMPOUNDS (TOXIC)								
1,3-BUTADIENE	ND	ND	ND	ND	ND	ND	ND	ND
ETHYLENE OXIDE	ND	ND	ND	ND	ND	ND	ND	ND
CARBON DISULFIDE	0.00156	0.00156	0.00156	0.00156	0.00156	0.00156	ND	0.00156
2-METHYL-2-PROPENAL	ND	ND	ND	ND	ND	ND	ND	ND
3-BUTEN-2-ONE	ND	ND	ND	ND	ND	ND	ND	ND
DIMETHYLDISULFIDE	ND	ND	ND	ND	ND	ND	ND	ND
2-ETHOXYETHANOL	ND	ND	ND	ND	ND	ND	ND	ND
OCTAMETHYLCYCLOTETRAILOXANE	0.12821	0.05823	0.12464	0.03049	0.11615	0.02570	0.00009	0.00417
NON-TARGET COMPOUNDS								
OCTAFLUOROPROPANE***	0.00040	0.00047	0.00045	0.00045	0.00065	0.00079	BL	0.00047
CHLOROPENTAFLUROETHANE	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	BL	0.00001
BROMOTRIFLUOROMETHANE	&BL	BL	BL	BL	BL	BL	BL	0.00004
2-METHYLPROPANE	BL	BL	BL	BL	BL	BL	BL	0.00011
HEXAMETHYLCYCLOTETRAILOXANE	0.23783	0.14348	0.27880	0.09469	0.22215	0.07195	BL	0.01107
LIMONENE	0.00010	0.00011	0.00012	0.00015	0.00017	0.00019	BL	0.00001
DECAMETHYLCYCLOPENTASILOXANE	0.02578	0.02076	0.02246	0.01853	0.03115	0.01800	BL	0.01091
TARGET COMPOUNDS (GC)***								
ETHYLENE	ND	ND	ND	ND	ND	ND	ND	ND
CARBON MONOXIDE	ND	0.05000	ND	0.05000	ND	ND	ND	0.30909
METHANE	0.00047	0.00053	0.00050	0.00045	0.00026	0.00026	0.00042	0.00789
HYDROGEN	0.00235	0.00235	0.00235	0.00235	0.00235	0.00235	ND	0.00235
CARBON DIOXIDE	1.00000	1.00000	1.00000	0.48462	0.44615	0.42308	0.06385	0.23846
TOTAL T-VALUE	1.55717	1.80729	1.60944	0.81667	0.96544	1.01047	0.08085	0.71130

* ND : Value is less than the laboratory report detection limit.

& BL: Area below the search routine limit (< 20% of the fluorobenzene peak area).

*** Measurements are calibrated by multi-point initial calibration and verified by mid-point continuing calibration.

TABLE 2B
ANALYTICAL RESULTS OF
ISS SOLID SORBENT AIR SAMPLES at the CONCLUSION of 7A and RETURNED on STS-104

	T-VALUE				
	AA03134 LAB SN0011 TUBE 2 4/09/01@17:45GMT 4/10/01@18:20GMT	AA03135 LAB SN0011 TUBE 3 6/13/01@08:15GMT 6/14/01@08:20GMT	AA03136 LAB SN0011 TUBE 4 7/09/01@15:45GMT 7/10/01@16:35GMT	AA03143 SERVICE MODULE SN0013 TUBE 2 4/09/01@17:50GMT 4/11/01@07:15GMT	AA03144 SERVICE MODULE SN0013 TUBE 3 6/13/01@08:20GMT 6/14/01@09:00GMT
TARGET COMPOUNDS (TO-14/POLAR)***					
FREON 12	0.00006	0.00004	0.00004	0.00003	0.00003
CHLOROMETHANE	0.00020	0.00017	0.00018	0.00017	0.00039
FREON 114	* ND	ND	ND	ND	ND
METHANOL	0.02502	0.02960	0.03130	0.00880	0.01579
ACETALDEHYDE	0.02970	0.09400	0.06473	0.01795	0.05295
VINYL CHLORIDE	ND	0.00269	0.00288	ND	ND
BROMOMETHANE	ND	ND	ND	ND	ND
ETHANOL	0.00043	0.00178	0.00153	0.00021	0.00098
CHLOROETHANE	0.00003	0.00003	0.00003	0.00003	ND
ACETONITRILE	0.00119	0.00104	0.00112	0.00104	0.00239
PROPENAL	ND	0.08333	0.10000	ND	ND
ACETONE	0.00313	0.00263	0.00336	0.00186	0.00268
PROPANAL	0.00222	0.00194	0.00208	0.00194	0.00444
2-PROPANOL	0.00079	0.00117	0.00100	0.00038	0.00124
FREON 11	ND	0.00001	0.00001	ND	ND
FURAN	ND	ND	ND	ND	ND
ACRYLONITRILE	0.00286	0.00250	0.00268	0.00250	0.00571
PENTANE	0.00001	0.00001	0.00001	0.00001	ND
2-METHYL-2-PROPANOL	0.00007	0.00006	0.00006	0.00006	0.00013
METHYL ACETATE	0.00007	0.00006	0.00006	0.00006	ND
1,1-DICHLOROETHENE	ND	ND	ND	ND	ND
DICHLOROMETHANE	0.03031	0.02508	0.02025	0.01566	0.02037
3-CHLOROPROPENE	ND	ND	ND	ND	ND
FREON 113	0.00005	0.00002	0.00002	0.00002	ND
N-PROPANOL	0.00029	0.00032	0.00045	0.00007	0.00016
1,1-DICHLOROETHANE	ND	ND	ND	ND	ND
BUTANAL	0.00182	0.00159	0.00170	0.00159	0.00364
2-BUTANONE	0.00103	0.00090	0.00122	0.00057	0.00053
CIS-1,2-DICHLOROETHENE	ND	ND	ND	ND	ND
2-METHYLFURAN	ND	ND	ND	ND	ND
ETHYL ACETATE	0.00023	0.00021	0.00019	0.00014	0.00019
HEXANE	ND	ND	ND	ND	ND
CHLOROFORM	ND	ND	ND	ND	ND
2-BUTENAL	ND	0.00412	0.00441	ND	ND
1,2-DICHLOROETHANE	0.00800	0.00700	0.00750	0.00700	0.01600
1,1,1-TRICHLOROETHANE	ND	ND	ND	ND	ND
N-BUTANOL	0.00451	0.00361	0.00494	0.00246	0.00309
BENZENE	0.04000	0.03500	0.03750	0.03500	0.08000
TETRACHLOROMETHANE	ND	ND	ND	ND	ND
2-PENTANONE	ND	ND	ND	ND	ND
PENTANAL	ND	ND	ND	0.00132	0.00302
1,2-DICHLOROPROPANE	0.00019	0.00017	0.00018	0.00017	ND
1,4-DIOXANE	ND	0.00010	0.00010	ND	ND
TRICHLOROETHENE	ND	ND	ND	ND	ND
2,5-DIMETHYLFURAN	ND	ND	ND	ND	ND
4-METHYL-2-PENTANONE	0.00006	0.00005	0.00005	0.00005	0.00011
CIS-1,3-DICHLOROPROPENE	ND	ND	ND	ND	ND
2-PENTENAL	ND	ND	ND	ND	ND
TRANS-1,3-DICHLOROPROPENE	ND	ND	ND	ND	ND
1,1,2-TRICHLOROETHANE	ND	ND	ND	ND	ND
TOLUENE	0.00103	0.00072	0.00117	0.00076	0.00066
HEXANAL	0.00131	0.00115	0.00123	0.00115	0.00262
MESITYL OXIDE	0.00020	0.00018	0.00019	ND	ND
1,2-DIBROMOETHANE	ND	ND	ND	ND	ND
BUTYL ACETATE	0.00004	0.00004	0.00004	0.00004	0.00008
TETRACHLOROETHENE	0.00024	0.00021	0.00022	ND	ND
CHLOROBENZENE	0.00017	0.00015	0.00016	0.00015	0.00035
ETHYLBENZENE	0.00016	0.00014	0.00015	0.00014	0.00032
META+PARA-XYLENES	0.00027	0.00021	0.00024	0.00018	0.00019
2-HEPTANONE	0.00035	0.00030	0.00033	0.00030	ND
CYCLOHEXANONE	0.00076	0.00055	0.00073	0.00038	0.00027
HEPTANAL	0.00114	0.00100	0.00107	0.00100	0.00229
STYRENE	0.00019	0.00016	0.00017	ND	ND
1,1,2,2-TETRACHLOROETHANE	ND	ND	ND	ND	ND

TABLE 2B
ANALYTICAL RESULTS OF
ISS SOLID SORBENT AIR SAMPLES at the CONCLUSION of 7A and RETURNED on STS-104

	T-VALUE				
	AA03134 LAB SN0011 TUBE 2 4/09/01@17:45GMT 4/10/01@18:20GMT	AA03135 LAB SN0011 TUBE 3 6/13/01@08:15GMT 6/14/01@08:20GMT	AA03136 LAB SN0011 TUBE 4 7/09/01@15:45GMT 7/10/01@16:35GMT	AA03143 SERVICE MODULE SN0013 TUBE 2 4/09/01@17:50GMT 4/11/01@07:15GMT	AA03144 SERVICE MODULE SN0013 TUBE 3 6/13/01@08:20GMT 6/14/01@09:00GMT
ORTHO-XYLENE	0.00049	0.00053	0.00044	0.00032	0.00049
1,3,5-TRIMETHYLBENZENE	ND	ND	ND	ND	ND
1,2,4-TRIMETHYLBENZENE	0.00053	0.00047	0.00050	0.00047	ND
1,3-DICHLOROBENZENE	ND	ND	ND	ND	ND
1,4-DICHLOROBENZENE	0.00027	0.00023	0.00025	0.00023	0.00053
1,2-DICHLOROBENZENE	0.00027	ND	ND	ND	ND
1,2,4-TRICHLOROBENZENE	ND	ND	ND	ND	ND
HEXACHLORO-1,3-BUTADIENE	ND	ND	ND	ND	ND
TARGET COMPOUNDS (TOXIC)					
1,3-BUTADIENE	ND	ND	ND	ND	ND
ETHYLENE OXIDE	ND	ND	ND	ND	ND
CARBON DISULFIDE	0.0005	0.00044	0.00047	0.00044	0.00100
2-METHYL-2-PROPENAL	0.00471	0.00412	0.00441	0.00412	0.00941
3-BUTEN-2-ONE	0.0186	0.01628	0.01744	0.01628	0.03721
DIMETHYLDISULFIDE	ND	0.03500	0.03750	ND	ND
2-ETHOXYETHANOL	ND	0.02333	0.02500	ND	ND
OCTAMETHYLCYCLOTETRAILOXANE	0.21333	0.06083	0.04000	0.03333	0.10333
NON-TARGET COMPOUNDS					
OCTAFLUOROPROPANE***	0.00025	0.00032	0.00045	0.00040	0.00091
CHLOROPENTAFLUROETHANE	0.00002	0.00002	0.00002	0.00000	0.00002
PROPENE	0.00001	0.00001	0.00001	0.00001	0.00001
CARBONYL SULFIDE	0.00167	0.00083	0.00083	0.00083	0.00250
TRIMETHYLSILANOL	0.00270	0.00270	0.00378	0.00108	0.00162
2-METHYL-PROPANENITRILE	0.00000	0.00000	0.00137	0.00000	0.00000
1,3-DIOXOLANE	0.00056	0.00056	0.00083	0.00028	0.00028
1,2-DIMETHOXYETHANE	0.00005	0.00005	0.00008	0.00003	0.00003
HEXAMETHYLCYCLOTRISILOXANE	0.07889	0.19111	0.07778	0.13333	0.35889
BENZALDEHYDE	0.00012	0.00006	0.00006	0.00012	0.00017
PINENE ISOMER	0.00007	0.00007	0.00007	0.00007	0.00007
2-ETHYL-1-HEXANOL	0.00038	0.00038	0.00075	0.00057	0.00019
LIMONENE	0.00020	0.00012	0.00023	0.00014	0.00012
DECAMETHYLCYCLOPENTASILOXSANE	0.01800	0.02267	0.03067	0.01867	0.02200
TOTAL T-VALUE					
	0.49975	0.66417	0.53822	0.31391	0.75940

* ND : Values are less than the laboratory report detection limit.

***Measurements are calibrated by multi-point initial calibration and verified by mid-point continuing calibration